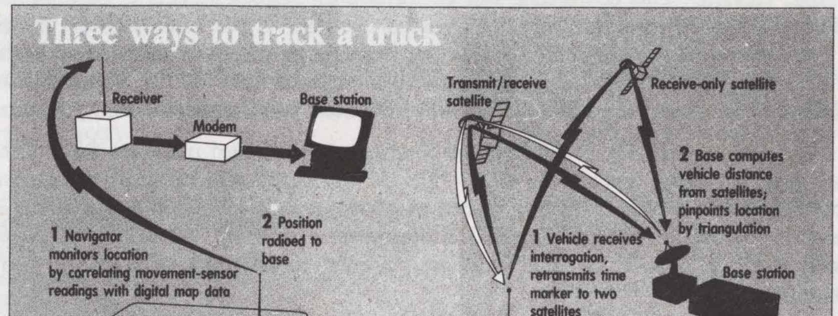
IEEE
VEHICULAR TECHNOLOGY SOCIETY
NEWSLETTER

Vol. 33, No. 4, November 1986 (ISSN 0161-7887) Editor: A. Kent Johnson

Position-Finding Vehicular Location Systems



Fleets can find their cars and trucks with any of three basic systems. Because Etak and loran locators are limited by radio range, satellite service is best for long-haul carriers—though vehicles may still get lost when cityscapes block signals.

See story on page 19.

President's Message

Robert Fenton
President
IEEE Vehicular Technology Society

By this time you have received the Call for Papers for VTC '87 which will be held in Tampa, Florida. This conference will be focused on various aspects of land mobile radio, vehicular electronics and transportation systems. If you have material in one of these areas, which could be used as the basis of an excellent paper, now is the time to organize it for presentation so it can be submitted by the December 15 deadline. Our goal is a great VTC '87 and we'll need your help in achieving it.

You have also received a ballot for the election of five board members for a three year term beginning January 1, 1987. I hope you voted and returned this ballot. Your vote is important as is our record of above average member participation in elections relative to that of other IEEE Societies. Hopefully, the latter reflects an above average interest in society affairs by our membership--obviously a very desirable condition.

You may have noticed that one of our long-time Board members, Al Goldstein, did not stand for re-election. This was due to heavy business commitments which will involve extensive travel. Al has made substantial contributions to VTS and we'll miss him. Hopefully, he will become active again in the future.

A continuing problem we have faced over the years is recruiting student members. This year we are trying something new--advertising frequently in POTENTIALS, the IEEE student magazine. We placed a full-page "recruiting" ad on the back cover of the October issue--an issue which should reach students just after their return from summer vacation--and a half-page ad in the December issue. Hopefully these ads, which highlight the major interests of our Society, will result in a substantial increase in our student membership. You can also help--if you know an EE student whose interests parallel those of VTS, please try to recruit him/her. If you need copies of the VTS Membership Brochure, please contact our Membership Chairman Mark Sihlanick (804-528-7115).

Your Board of Directors will hold its next meeting in late January or early February. All of us would appreciate hearing from you about issues that should be considered.

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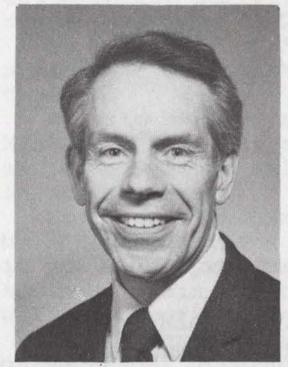
Editor's Notes



A. Kent Johnson
Newsletter Editor

AS the November issue of the VTS newsletter goes to press, the time is once again approaching when the IEEE is looking for Fellow nominations from among its/ ranks. We are always anxious to see qualified members of VTS receive this honor. We accordingly urge any of you who know of a qualified VTS member who has not yet been nominated to receive the rank of Fellow to submit such a nomination. The new IEEE Fellow nomination kits are available and will be furnished upon request from:

Staff Secretary, IEEE Fellow Committee
345 East 47th Street
New York, NY 10017
Telephone (212) 705-7750

If you need help in this nomination process, our VTS Fellow Awards Chairman is:

R.A. Isberg
1215 Henry Street
Berkeley, CA 94709
(415) 526-1446

and he has offered to provide such assistance. A reminder that only Senior Members are eligible to be nominated for Fellow rank and we are aware that many out there are eligible to be Senior Members and Mr. Isberg can provide assistance and necessary forms for that process also.

Month of Issue	Final Copy to be Rec'd By VTS Editor	Target Mailing Date
February	12-30-86	1-27-87
May	3-10-87	4-14-87
August	6-09-87	7-13-87
November	9-13-87	10-15-87

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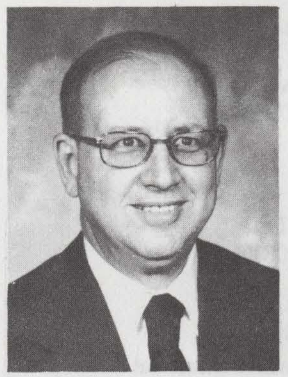
Transportation Systems



Bob McKnight
Transportation Systems Editor

35 Year Rail Official retires from Seaboard System Railroad

Robert D. Liggett, Chief Communications and Signals Officer, Seaboard System Railroad, retired June 30, 1986 after serving the rail industry for over 40 years, 35 of which were spent with Seaboard and its predecessor companies.

A graduate electrical engineer from Purdue University, Mr. Liggett joined Union Switch & Signal Co. following World War II duty with the US Navy. In 1951 he joined the Atlantic Coast Line Railroad as traffic control system engineer. When ACL merged with Seaboard Air Line, Mr. Liggett became Chief Engineer Communications & Signals, later becoming Chief Communications and Signals Officer.

During this time he was active in Association of American Railroad's Communication & Signal Division serving on the C&S Division Committee of Direction and was twice Chairman of the Division. Also, he was an active member of its Committees on Special Applications and Highway Grade Crossing Warning Systems.

On August 16, 1986, some 150 friends and co-workers honored Mr. Liggett with a retirement dinner. As a tribute and thanks for his many years of service to the industry, he was presented with a

ROBERT D. LIGGETT (right) gets handshake and thanks along with plaque from AAR Vice President BILL JOHNSTON. Liggett was honored for over 20 years service to railroad industry by the Association of American Railroads.

plaque from the AAR by Vice President A. William Johnston. The plaque reads: "Association of American Railroads, Communication & Signal Division takes pleasure in presenting this placque August 16, 1986 to R. D. Liggett in recognition and appreciation for his numerous contributions and prudent counsel while serving as Chairman and member of the Committee of Direction for over 20 years." It was signed by A. W. Johnston, and by L. M. Himmel, Sr., Executive Director, C&S Division, AAR.

Implementing high technology for today's railroading will highlight AAR Communication & Signal meeting

Kansas City, MO will be the meeting place for railroad communications and signal officers November 4-6, 1986 where they will learn more on how to apply high technology to today's railroading.

Keynote speaker on the first day will be J. R. Davis, Executive Vice President, Union Pacific, one of the major US railroads now participating in the Advanced Train Control Systems project, an industry research program.

Other major speakers on the opening session include John Riley, Administrator, Federal Railroad Administration, and an official of Federal Communications Commission Private Radio Bureau. A. W. Johnston, Vice President Operations & Maintenance, AAR, will discuss the state of the industry; and Executive Director Leo M. Himmel, Sr., will report on the activities of the C&S Division during the past year.

One concurrent session on Tuesday afternoon will lead off with speakers F. R. Wix, Chairman of C&S Division Communications Liaison Subcommittee and L. Robert Raish, AAT consulting attorney, who will discuss the 1987 World Administrative Radio Conference.

Technical papers will include:
-- Norfolk Southern's CARS system for reporting data via a portable computer-radio terminal to a central location.
-- Computer controlled automatic dialer for automated railroad crew calling.
-- Touch CRT for dispatcher communication control.

Another concurrent session on opening Tuesday afternoon will feature signal and control topics. Forrest McIntyre, Chairman of the Signal Liaison Subcommittee will report on activities of the rail industry with federal agencies, especially the Federal Railroad and Federal Highway Administrations. J. W. Walsh, Associate Administrator for Safety, FRA, will report on the activities of safety regulation enforcement.

Technical papers will include:
-- Signaling systems for high-speed rail lines in France.
-- Locomotive drivers passing railway signals at danger on Indian Railways; a psychological study and explanation.
-- Technological advancements in computer-aided dispatching.
-- Total traffic management using the latest in computer and data base management technology.
-- Structured software- a design criteria for software controlled vital signal systems.

On Wednesday morning, Committee Day activities will kick off with Communications topics:

Reports by Committee B- Radio and Microwave Systems; and C- Communication and Data Systems will cover activities in the industry.

Radio data transmission tests done by Norfolk Southern and Union Pacific in preliminary efforts concerning the Advanced Train Control Systems project will be reported by a panel of experts.

Four technical committees will report on Wednesday afternoon: D- Highway Grade Crossing Warning Systems; E- Signal Systems; F- Special Applications; and H- Electromagnetic Compatibility.

Paul Oakley, Executive Director, State-Rail Programs Division, AAR, will report on federal funding for rail-highway grade crossing safety improvements.

Technical papers will include:
-- Return on investment with a track side analyzer consisting of several defect detectors located at one site to monitor passing trains.
--Lightning and surge arresters and protection techniques for railroad communications.
-- Hybrid protector design plus good grounding and installation techniques can protect electronic equipment against voltage transients.

Final day session will begin with a report of Committee G- Education and Training.

Technical papers include:
-- Training of Federal Railroad Administration Signal & Train Control Inspectors.
-- Home study electronics course is successful for railroad employees.
-- A supplier's perspective on the Advanced Train Control Systems project.
-- Application of locomotive data radio systems for advanced train control functions.
-- A VHF radio based data communication system for railroad operations.

On Thursday afternoon, the final session will be devoted to discussion of the industry's Advanced Train Control Systems Project. A progress report plus full discussion of where the project stands with audience participation expected. Major discussion areas will include:
-- Computer systems
-- Communications systems
-- Signal systems
-- Motive power and locomotive equipment
-- Systems engineer
-- Operations
-- Economic assessments
-- Track and roadway engineering
-- Regulatory impacts.

At present, several component specification drafting committees are at working producing draft specifications. Some are:
- Overview system architecture
- Communications system overview architecture
- Dispatch system architecture
- Field systems architecture
- Transponder/Interrogator system architecture.

1985 PAPER OF THE YEAR COMMITTEE RESULT

The committee reviewed many fine papers that appeared in the VTS Transactions for 1985. The tree criterion used by the committee for selection were:

1. The paper must be based on original work. It can't be a tutorial or summary of previous work nor can it be a limited extension of a technology. In other words, it has to be, as a minimum, a significant step over prior work.

2. The paper has to be written and organized in a clear, concise way and understandable to one familiar with the particular technology.

3. The paper and its content must be archival. By that, it is meant that the paper must have apparent reference value to current and future researchers in the particular technology.

Although many of the papers met two of the above, none met all three of the criterion necessary to be considered as candidates for "Paper of the Year". Although this result is disappointing, it does speak to the quality of the award and is a compliment to the many winning authors of past years.

Chuck Lynk
Motorola, Inc.
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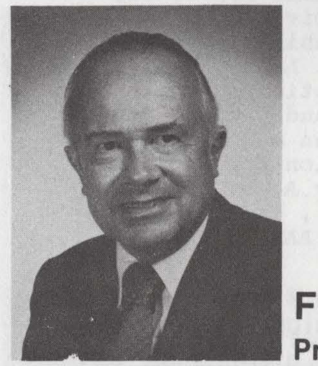
Professional Activities



Frank E. Lord
Professional Activities Editor

Impressions of the National PACE Conference

Regular readers of this column may recall that in the February 1986 issue of our newsletter, I reported on the 1985 National PACE (Professional Activities Committees for Engineers) Conference. This event has been held on Labor Day weekend for quite a few years now. It's not the kind of gathering that all employers would be enthusiastic about and support, so attendees can avoid having to use vacation time or taking time off without pay by using the holiday weekend for this purpose.

At this writing I have just returned from the 1986 PACE Conference and I would like to share some of my impressions with you. The topics are many and include those intended to orient new PACE leaders as well as those that report on initiatives in such areas as pensions, age discrimination, alien engineers, student awareness and professional data gathering. When the conference was over I heard the gamut of comments from "best yet" to "terrible". I know that those two expressions need not be incompatible, but in this case I believe there was a genuine wide spectrum of reaction to the proceedings. I, myself, experienced a considerable range of reactions. There were many things I viewed favorably and also quite a few that were disappointing or even distressing.

My report on the previous conference dwelt on the talk by Bob Bruce, delivered on the afternoon of the last full day, that was very critical of what was happening in USAB/PACE. This year Bob spoke on the morning of the first full day and delivered what could have been considered a keynote address titled "Gut Issues". The disappointment was that, that was the last mention of most of the gut issues in the whole conference. It was also disappointing that Bob's talk was essentially the same as the one he gave the year before thus indicating a lack of progress on any of those issues during the year. I have since suggested that in the future conferences one of the early sessions cover highlights of progress and accomplishments during the previous year and be titled something like "Top Ten USAB/PACE Successes of 19XX".

There had been no opportunity for attendees to prioritize their needs and concerns prior to the Conference. Consequently the conference did not address many of them. This is correctable. Some concerns surfaced in the wrap-up session on the last day when members started introducing initiatives from the floor. Many thought there should be a designated session for this purpose at future conferences.

As the conference progressed it became apparent that many of us did not have a good overall view of what was going on in professional activities. This became apparent when someone would suggest that a specific action be taken and another member would rise to point out that it was already being done. It appeared that not everyone had done homework for this action oriented event.

Do you think Space Art, Parts Obsolescence, and Pre-College Education have a place on our professional activities agenda? A few people did because they were certainly there, but most did not by my observations.

Sometimes phrases that are frequently used tell you a great deal about how people are thinking. I noted "preaching to the choir" occurred quite a bit. Most distressing though were "technical side of the house" and "USAB side of the house". It appears that there are still a great many people who ;do not view our Institute as a matrix organization where each individual should realize the value to him of all the activities even though he may not be able to be involved with all facets at any one time. Incidentally, one person who seems to have total multi-faceted involvement in IEEE is our own VTS Board member, George McClure, who was at the Conference by virtue of two PACE offices that he holds.

I also heard some comments to the effect that USAB was spreading its resources over too many activities thus making them all under supported and not prone to success. There are those who think we should prioritize needs and concentrate our efforts on the high priority items.

I noted most favorable comments about the following activities:

Student Professional Awareness Conferences (SPAC)

Age Discrimination (we work against it)

Pensions

Surveys

Professional Publications
(Such as "Professional Practices for Engineers, Scientists and Their Employers" and "IEEE Members' Professional Needs")

The candidates for President-Elect and Executive Vice President were featured on the platform at lunch on Sunday where they stated their views and took turns responding to a set of questions. This was a very popular event although one wonders what the possible effect on the election could be, there being only around two hundred members at the conference.

After lunch Ben Leon led a session on Continuing Engineering Education. I wonder if he felt like the first marcher in the parade behind the horses.

I was pleased with a topic presented by Arvid Larson during the Technology Activities Council Review on "Defense Electronic Materials Initiative". This effort examined an old concern in a new way and by so doing provided for new problem solutions. It introduced to the Defense Department and the Congress the concept of a limited size, limited life organization to address a specific critical problem. The ideas generated by this effort seemed to benefit all parties i.e. DoD, the taxpayers and the engineering community.

I had expected that taxes and whistle blowing would get a great deal of attention and was disappointed that they didn't. I had noted an article in the Wall Street Journal of August 26, 1986 to the effect that a feature of the tax legislation would allow employers to reduce payments to retirees who opted for a lump-sum pension payment. I called this to the attention of appropriate people at the conference who were not yet aware of it. I am hopeful that some favorable action results.

The Conference will be reported at greater length in an official report published by the Washington office which by now is probably available from them.

IEEE Standard 263

We are publishing below a copy of IEEE Standard 263 in order to receive feedback from you as to whether or not it should be abandoned. Please look it over in light of the information below and give us your comments.

IEEE Standard 263 provides a method of measurement of ignition interference in mobile communication receivers. This standard was prepared by a joint committee of VTS and EMC in 1965. Under the rules of the IEEE Standards Board, it has long been overdue for an updating. We have several times attempted to get volunteers to participate on a committee to do this. We have also personally solicited individuals, who are familiar with the problem, without success. EMC Standards Board reviewed a proposed revision a few years ago and rejected it. SAE also rejected it. EMC is about to recommend to the Institute Standards Board that we officially abandon it. Unlike SAE's Standard, which provides a far field intensity measurement, the 263 Standard provides a near field measurement. The value of the IEEE method, is that the value of the measurement can be consistently repeated and is not subject to the vagaries of the propagation environment.

I would appreciate input from VTS members as to whether we should revise or abandon Standard 263. I would also appreciate a response from anyone who would be willing to act on a committee to accomplish a revision. Please send comment and replys to:

J.R. Neubauer,P.E.
P.O. Box 125
Collingswood, N.J. 08108

MEASUREMENT OF RADIO NOISE, GENERATED BY MOTOR VEHICLES, AND AFFECTING MOBILE COMMUNICATIONS RECEIVERS IN THE FREQUENCY RANGE 25 TO 1000 Mc/S

1. INTRODUCTION

The purpose of this Standard is to provide a uniform method of measurement of radio noise generated by a motor vehicle, which may affect the performance of mobile communications receivers in the vehicle.

2. NATURE OF THE RADIO NOISE

The radio-frequency noise generated by motor vehicle electric systems is characterized by a broad frequency spectrum, portions of which may degrade received signal intelligibility. Vehicular radio noise has been shown, experimentally, to be essentially impulsive in nature. The repetition rate of the impulses will depend upon the nature of the ignition system. A measure of the radio noise level can be obtained by a substitution method using a standard impulse noise source. The indicated radio noise level is a measure but not a complete measure, of the interference effect. The interference effect noted in mobile communications equipment for a given indicated radio noise level will vary depending upon the ignition system design.

2.1 Definitions

For the purpose of this Standard, the following terminology will apply:

2.1.1 Voltage Impulse: A voltage impulse is defined as a voltage pulse of sufficiently short duration as to exhibit a frequency spectrum of substantially uniform amplitude in the frequency range of interest. As used in this Standard the voltage impulse has a uniform frequency spectrum over the frequency range 25 to 1000 megacycles per second.

2.1.2 Spectrum Amplitude: The voltage spectrum of a pulse can be expressed as

$$V(\omega) = R(\omega) + jX(\omega) = \int_{-\infty}^{+\infty} v(t)\, e^{-j\omega t}\, dt$$

where

$$R(\omega) = \int_{-\infty}^{+\infty} v(t) \cos \omega t\, dt$$

$$X(\omega) = -\int_{-\infty}^{+\infty} v(t) \sin \omega t\, dt$$

and

$$\omega = 2\pi f$$

The spectrum then has the amplitude

$$A(\omega) = \sqrt{R^2(\omega) + X^2(\omega)}$$

and a phase characteristic

$$\phi(\omega) = \tan^{-1} \frac{X(\omega)}{R(\omega)}$$

The inverse transform can be written

$$v(t) = \frac{1}{\pi}\int_0^{\infty} A(\omega) \cos \left[\omega t + \phi(\omega)\right] d\omega \text{ for } real\ v(t)$$

An impulse is a function of short time duration compared with the reciprocals of all frequencies of interest. Its spectrum has an amplitude that is substantially uniform (in this frequency range), and its spectrum amplitude, A (ω) is the area under the impulse time-function and has dimensions of volt-seconds.

The spectrum amplitude is also expressible in volts per cycle-per-second as follows:

$$S(f) = \frac{1}{\pi} A(\omega) \text{ volts/(c/s)}$$

It is this form that is used as the basis for calibration of commercially available impulse generators.

2.1.3 Frequency Selective Voltmeter: A selective radio receiver, with provisions for output indication. For the purpose of this Standard, it must meet the performance characteristics described in paragraph 3.1.4.

2.1.4 Impulse Generator: A standard reference source of broadband impulse energy. For the purpose of this Standard, characteristics described in paragraph 3.1.3 must be met.

2.2 Sources of Vehicular Radio Noise

Motor-vehicle radio noise arises principally from the ignition circuits of gasoline (or similar) engine-driven vehicular equipment in which steep wavefront electric transients are generated by the high-voltage electric discharges such as occur across the distributor or spark plug gaps. A secondary, but nonetheless troublesome, source of noise is the battery charging circuit, in which electric transients are generated as a result of commutation by the charging generator and by the regulator. Other lesser sources of noise which occasionally are troublesome are the fan belt, gauges and instruments, and the generator shaft.

2.3 Vehicular Radio Noise Field

Mobile communications receivers have, in general, sensitivity comparable to the best available measuring equipment. Therefore, the measuring antenna must be in close proximity to the vehicle being tested. Under these circumstances, the antenna is immersed in a very complex field exhibiting high field strength gradients. At low frequencies, the induction field predominates while at higher frequencies the radiation field predominates. Therefore, the method of measurement relies on the specification of measurement antenna type together with antenna placement and orientation with respect to the vehicle under test.

3. METHOD OF MEASUREMENT

This Standard describes a method of measurement of the radio noise in terms of the output of an impulse generator providing a calibrated spectrum amplitude. Figure 1 illustrates the measuring principle. The radio noise at each desired frequency is measured as the open-circuit antenna terminal voltage with a frequency-selective voltmeter. The measurement is accomplished by a substitution method using a calibrated impulse generator. Industry practice, reflected in currently available instruments suited to the implementation of the measuring method described in this Standard, calibrates the output of the impulse generator in terms of "microvolts per megacycle-per-second bandwidth and dB above one microvolt per megacycle-per-second bandwidth". This calibrated signal is series injected into the antenna circuit of the receiving antenna in such a manner as to make the absolute value of the measurement substantially independent of antenna and instrument input impedances. When the radio noise and the calibrated impulse generator inputs, applied consecutively, produce the same peak response from the frequency-selective voltmeter, the measured value of the radio noise is equal to the impulse generator output corrected for the attenuation of the calibrated injection network (20 dB) and for the loss occurring in the cable connecting the impulse generator to the injection network. Because of the complex nature of a vehicular radio noise field as described in paragraph 2.3, correlation of measured results obtained from this method of measurement requires the use of the prescribed type antenna placed and oriented in the prescribed manner with relation to the vehicle under test. The antenna described in this Standard is a relatively compact broad-band antenna affording a good match to a 50-ohm measurement system. Also, this antenna, like vehicular communication antennas in general, is primarily responsive to a vertically polarized electric field. A 50-ohm measurement system allows the use of readily available 50-ohm coaxial cables, connectors, and attenuators.

3.1 Test Equipment

The frequency selective voltmeter when used with a calibrated impulse generator and an appropriate series injection network shall be capable of measuring open circuit antenna voltage in terms of microvolts per megacycle-per-second bandwidth or in terms convertible thereto.

3.1.1 The antenna shall be of the type shown in Figures 2 and 3. The method of joining the mast sections to the cone and to each other shall provide for good electrical conductivity over the frequency range of antenna use.

3.1.2 All measurements shall be performed using an injection network meeting the performance requirements detailed in Figure 4. A typical injection network device which meets the specified performance requirements is shown in Figure 5.

3.1.3 The calibrated impulse generator[1] when applied to a 50-ohm resistive load, shall provide an output which is flat within ± 1.0 dB over the frequency range of interest with maximum output sufficient to measure the desired range of spectrum amplitude. The impulse generator shall provide for output adjustment within ± 2 dB of indicated output. A pulse repetition frequency between 50 and 400 impulses per second shall be available.

3.1.4 The frequency selective voltmeter shall possess the following electrical characteristics as a minimum performance requirement.

3.1.4.1 An impulse signal having a voltage spectrum amplitude of 40 microvolts per megacycle-per-second bandwidth applied across the input terminals must produce at least a 2 dB rise in peak meter indication. For instruments with aural-slide-back peak detectors, a 40 microvolts per megacycle-per-second bandwidth signal shall produce usable audio response.

3.1.4.2 The spurious response rejection shall be at least 35 dB.

Note 1: Impulse generators are often calibrated by comparison with the rms output of a sine-wave signal generator. When this is so, the reading of the impulse generator is 0.707 of the true spectrum value.

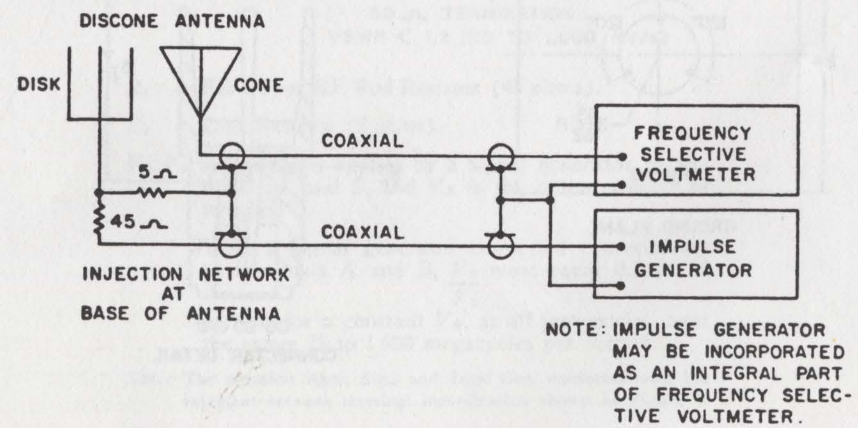


Figure 1

Principle of Measurement of Open-Circuit Antenna Voltage with Antenna Injection Network

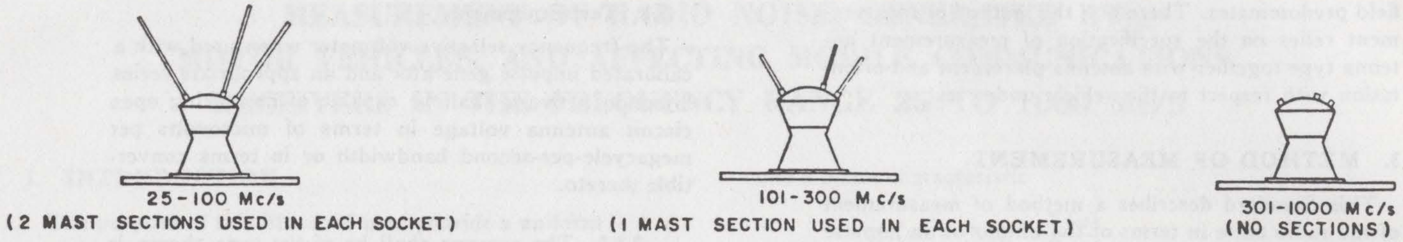


Figure 2

Antenna Configurations for Frequency Range 25-1,000 Mc/s

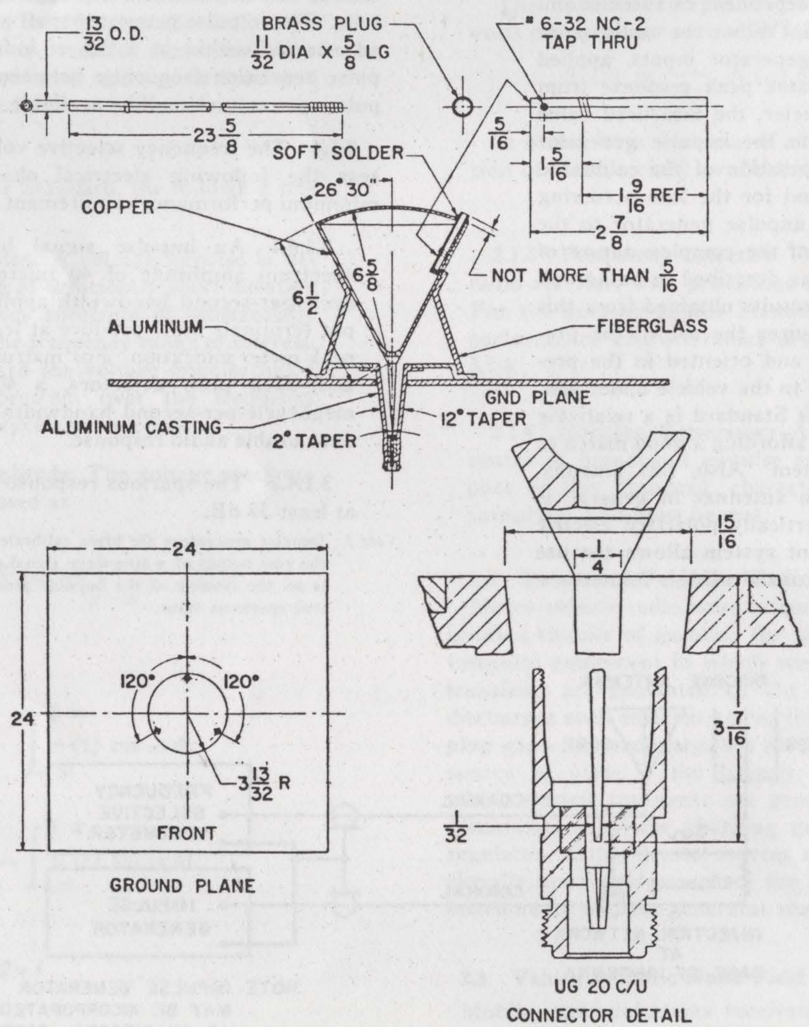


Figure 3

Antenna Details Pertinent to Radio Interference Measuring

3.1.4.3 The pulse turn-over effect shall produce no more than ± 0.5 dB change in peak meter indication. This test is performed by reversing the polarity of an applied impulse generator signal of 15,000 microvolts per megacycle-per-second bandwidth at the input terminals with minimum input attenuation required to keep the meter on scale. The frequency spectrum of the impulse generator used to perform this test shall be at least as broad as that of the impulse generator used in performing the measurements described in paragraph 3.2.

3.1.4.4 If a meter indicator is used, the peak meter indication shall not change more than 0.5 dB when a constant amplitude impulse generator signal is varied from 50 to 400 impulses per second.

3.1.4.5 The input impedance shall be nominally 50 ohms.

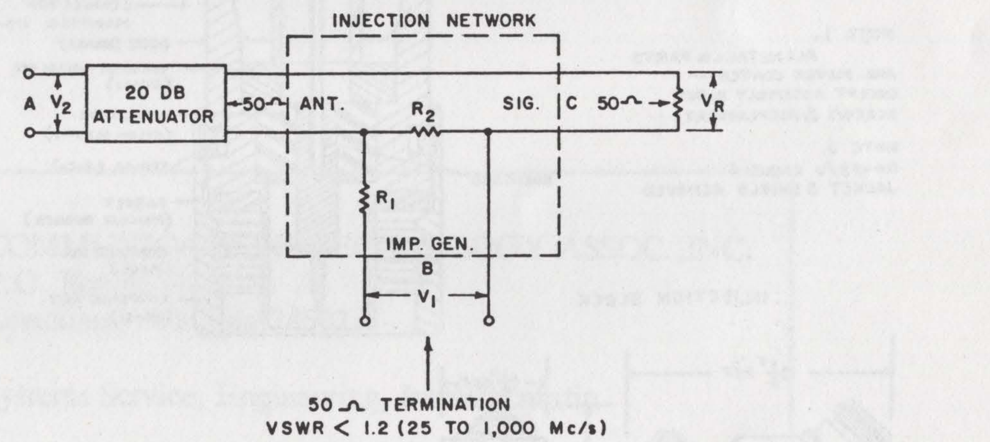
3.2 Test Procedure

Radio noise shall be measured at the front and rear of the vehicle over the frequency range of interest. In the event radio noise from sources other than the vehicle is encountered at the frequency of interest, measurement shall be made at the nearest unoccupied frequency. The vehicle and test equipment antenna shall be arranged as shown in Figure 6, with the antenna configuration as shown in Figure 2. The measuring equipment shall be located at least 20 feet from the measuring antenna and the vehicle under test. For each measurement the level recorded shall be the maximum value observed, when the vehicular engine speed is varied smoothly from idle to race.

3.3 Test Conditions

3.3.1 **Test Area:** The measurement site shall be open flat terrain at a considerable distance (100 feet or more) from reflecting or conducting objects such as large buildings, electric lines, buried pipes, metallic fences and trees. The ambient interference at the test area shall be at least 6 dB below the test limit at any frequency of interest.

3.3.2 **Vehicle Condition:** The vehicle under test shall be dry and the engine compartment closed.



R_1 Film Type RF Rod Resistor (45 ohms).

R_2 Disk Resistor (5 ohms).

V_1, V_2 are voltages applied by a signal generator to terminals A and B, and V_R is the output voltage at terminal C.

With a signal generator connected consecutively to terminals A and B, $\frac{V_2}{V_1}$ must equal 0.5 ± 15 percent for a constant V_R, at all frequencies, over the range 25 to 1,000 megacycles per second.

Note: The notation Ant., Sig., and Imp. Gen. conforms with the injection network terminal identification shown in Figure 5.

Figure 4

Injection Network Performance Requirements (25 to 1,000 Megacycles per Second)

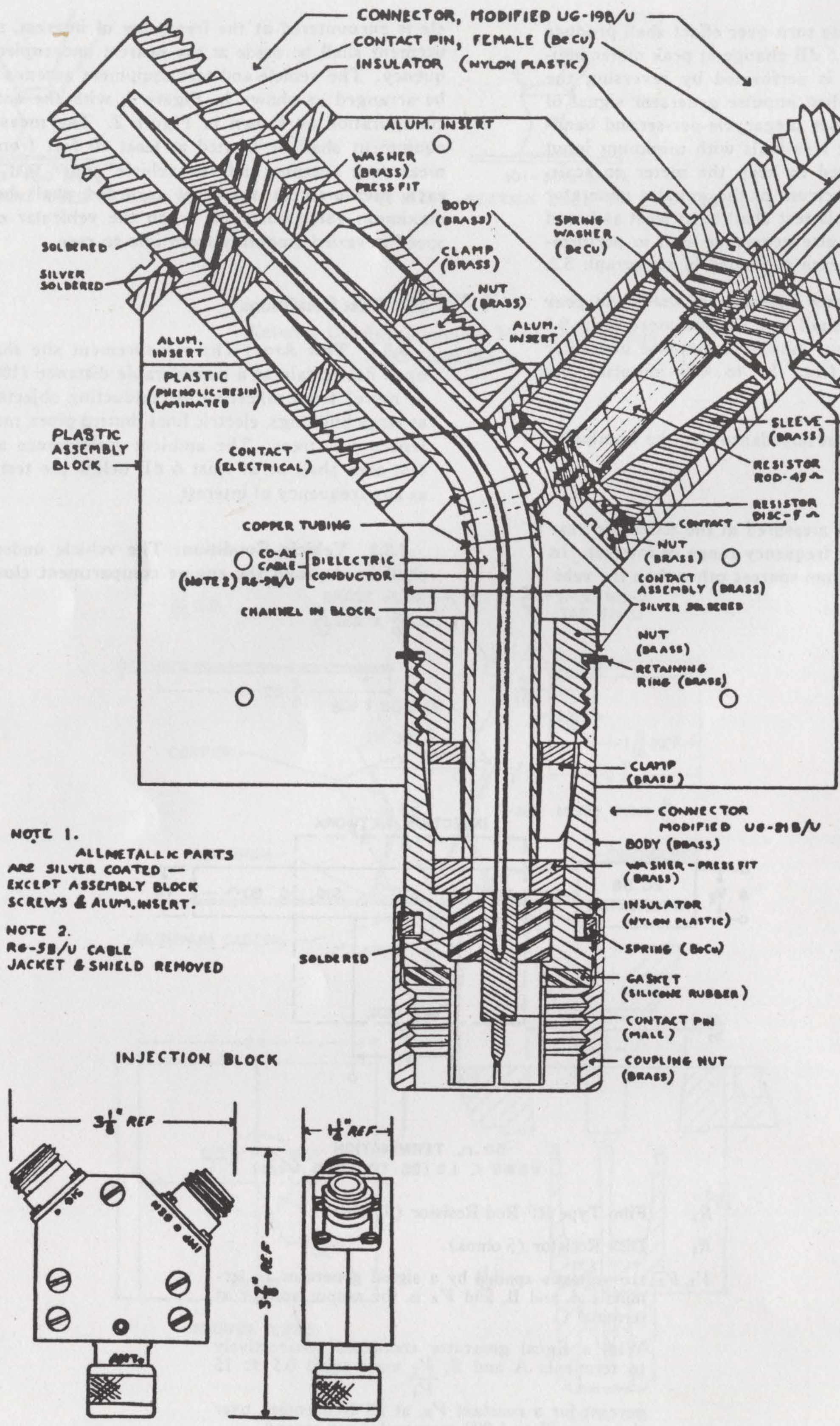


Figure 5
Typical Injection Network Assembly

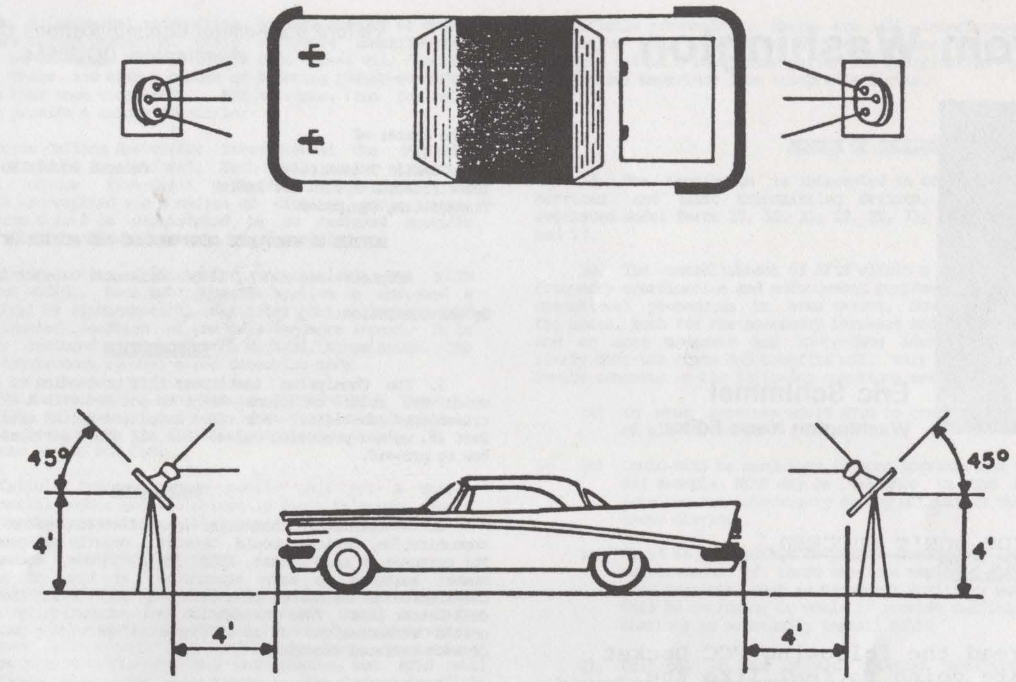
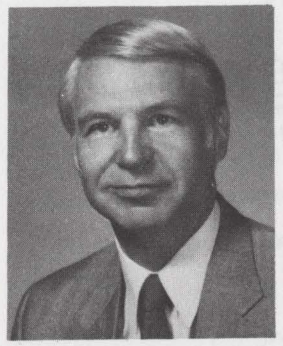


Figure 6
Positioning of Antenna in Radiation Test of Automotive Vehicles

News From Washington



Eric Schimmel
Washington News Editor

IF AT FIRST YOU DON'T SUCCEED,
TRY ANOTHER DOCKET

As you read the following FCC Docket some of you are going to feel like the fellow who went to the doctor for a diagnosis of a recurring but unidentified ailment. Following his examination the doctor asked the patient if he had ever experienced this ailment before. When he replied that he had, the doctor's profound diagnosis was: "Well, you've got it again." We also have got it again. As the FCC text notes, the idea of mandating ATIS is over ten years old (Docket 20351), lying dormant but not dead until catalyzed by the Captain Midnight fiasco.

At that time industry comments adamantly opposed the imposition of an ATIS requirment. While there may be an inclination to dust off and resubmit those comments, I think we should take the time and make the effort to take another look at this issue. For one thing, the technology considerations are substantially different today than they were ten years ago. I don't believe, however, that equipment factors are the key determinants in this proceedings. Rather I think the viability of an ATIS program rests on the answer to the questions of how will the ID be administered and who will maintain the data base. I doubt that the FCC will accept that indispensible responsibility.

Because of the time lapse in the publication process, it is not always possible to publish government proceedings in time for readers to meet response deadlines. In the case of this docket, the Comment and Reply Comment due dates are October 20 and November 19, respectively, but there is a strong probability that these dates will be extended. If you are interested in responding to the questions posed in the Inquiry, I suggest that you check on the current status of these due dates.

Before the Federal Communications Commission
Washington, DC 20554

In the matter of	)	
	)	
An Automatic Transmitter	)	General Docket No. 86-337
Identification System for Radio	)	
Transmitting Equipment		

NOTICE OF PROPOSED RULE MAKING AND NOTICE OF INQUIRY

Adopted: August 7, 1986 Released: August 19, 1986

By the Commission:

INTRODUCTION

1. The Commission institutes this proceeding to establish a means by which all radio emissions might be encoded with a distinct automatically transmitted identifier. For video satellite uplink stations regulated under Part 25, we are proposing rules. For all other services we seek comments on how to proceed.

BACKGROUND

2. An automatic transmitter identification system (ATIS) for all radio communication devices would benefit orderly management of the spectrum. For purposes of this Docket, ATIS is a unique, unchangeable identifying number assigned to each transmitter at time of manufacture plus some correlation of the number to a data base identifying the licensee, such as a call letter list. This information is automatically modulated onto the unit's transmission. It is a "signature" providing positive identification of each radiated signal.

3. Expanded technologies, spectrum crowding, more critical radio uses, readily available multi-channel equipment, smaller regulatory budgets, and other reasons make it increasingly difficult to satisfactorily resolve radio interference problems. For example, in the past few years there have been several acts of deliberate interference to aviation communications in alleged retaliation for employer disputes. Aviation Emergency Locator Transmitters exhibit a 97% false activation rate with resulting searches. On a frequent basis, unintentional, as well as intentional, jamming occurs on the marine distress and Bridge-to-Bridge frequencies. Also, hundreds of false distress maydays are transmitted each year. These are illustrative of just a few safety-related radio interference problems where ATIS could have a significant impact. Of course there are many more non-safety related interference problems such as amateur repeater jamming, groups of pilots engaging in "CB" type conversations on aviation channels, broadcast electronic news gathering equipment suddenly causing disruptions and the proximity problems with electronic home entertainment equipment.

4. Deliberate disruptions of radio communications have even spread to satellite transmissions. An individual using the pseudonym "Captain Midnight" captured and displayed his message through a satellite transponder by overpowering the legitimate transmission on the transponder. United States Representative, Timothy E. Wirth, Chairman, Subcommittee on Telecommunications, Consumer Protection and Finance of the Committee on Energy and Commerce, has indicated that this act represented "a major potential threat to the nation's entire communications system." Congressman Wirth further requested that the Commission "initiate a proceeding at the earliest possible date in order to explore fully the feasibility and desirability of developing a detection system based upon the encoding of satellite transmission equipment or other practical detection methods." This recommendation was in agreement with the industry produced Phase II Final Report of the FCC Advisory Committee on Reduced Orbital Spacing.

5. Technical and operational reasons necessitate an ATIS system. For example, a fast food chain of restaurants, using two way radio headsets in its operations, finds it administratively impossible for its employees to utilize the verbal call sign because of confusion to the customers and a busy operational environment. Similarly, some station operators in the construction industry, such as a crane operator, are often, out of necessity, so preoccupied with the critical performance requirements of their jobs that they are reluctant to disrupt their concentration to identify. There are also many telemetry-only systems where voice is simply not compatible.

6. The concept of ATIS is not new or untried. Many operational systems utilize a form of automatic transmitter identification for their own requirements. These systems demonstrate the ability of ATIS to adapt to a wide range of communication systems and needs. ATIS takes the present station identification requirements and applies them in automatic fashion. The need for transmitting call letters is well established by present rules. By employing ATIS the transmission of a call sign/identification number will be included with each message without personal intervention by the operator. It is automation of an existing function and an increase in reliability.

7. Over 10 years ago in Docket 20351, the Commission released a Notice of Proposed Rule Making looking toward adoption of an ATIS requirement. Many of the comments at that time focused on deficiencies of the rigidly proposed system because it was incompatible with certain specific systems, it increased channel occupancy, or it was economically unsound. We believe these objections are technically resolved or resolvable at this time.

EXISTING ATIS SYSTEMS

8. As a spectrum manager, the Commission has a responsibility to encourage orderly development of communication technology. Sharing of frequencies is necessary for the fullest utilization of the radio spectrum. The rules that recognize this may entail the acceptance of some interference but do not contemplate the acceptance of harmful interference. With regard to ATIS, an endorsed preferred identification code will encourage

compatibility, provide a universal recognition, provide economy of scale, and provide an immediate design criterion. While a single identification code is preferable, we recognize that no single code scheme will function in all situations. There are also a number of existing pseudo-automatic identification systems that seem acceptable. For example, the following coding techniques each provide a unique identifier:

1) Marine Selective Calling System for International Use (Appendix 39 of the ITU Radio Regulations). Each mobile marine station is assigned a unique five-digit selective call signal. The identifier is transmitted via a series of distinct audio tones. Each digit from 0 to 9 is represented by an assigned specific audio tone. Timing and tolerance are also specified.

2) Marine Digital Selective Calling for International Use (CCIR Recommendation 493-3). Each mobile marine station is assigned a unique numerical or alphanumerical identifier that is incorporated into a designated location of the call sequence format. It is automatically included as part of each digital transmission. The system is a synchronous 10-unit error detecting code.

3) 406 MHz ELT/EPIRB Beacons for the Future COSPAS-SARSAT Network. Each ELT/EPIRB is assigned a unique identification code that is specified in location in the digital transmission format. It is currently based on the BCH Code.

4) Land Mobile Cellular Systems. Each mobile unit has a unique factory-set serial number and a distinct 10 digit telephone number that are digitally transmitted. It is based on the BCH Code.

BENEFITS OF ATIS

9. A review of rulemakings in the last 10 years discloses a constant chipping away of the basic station identification rules based on unique circumstances, undue hardship, and "lack of interference" considerations. The dilution has been substantial, but indeed necessary. Conventional identification has not been possible with many technologies, but ATIS will allow more flexibility and greater acceptance. The obvious immediate benefit of ATIS is to interference resolution where the first step is always to identify the stations involved. It will provide a distinct "signature" on the transmissions of both unintentionally and deliberately involved stations. Under ideal operating practices the announcement of a call sign would provide this identification for the unintentionally involved station in many services, but our experience shows that in services where identification is required, many transmissions are made without call sign identity. For example, 25% or more of the voice transmissions of Private Land Mobile Radio Service stations are unidentified. There are also services where identification is not required such as telemetry, satellite, Citizens Band, and low power communication devices. Almost all "voice system" users want alternatives to the assigned call sign. Indeed, CB was famous for millions of colorful pseudonyms such as Tinkerbell, 007, Fun Radio, Rescue 1, and so forth, none of which from our point of view had utility as station identification. An automatic identification system will also be effective against common daily co-channel interference problems such as the "stuck" microphone, the inadvertently keyed transmitter, and satellite double illumination.

10. Frequency coordinators could utilize ATIS to assist in determining usage, propagation range, unauthorized users, and resolving interference problems and more. ATIS could provide the ability to develop automated monitoring systems that could capture the information instead of using present labor intensive collection methods. With Commission reliance increasingly placed on coordinators, they could develop enhanced capability through ATIS.

11. When all systems are automatically identified, it may be possible to relax some present regulatory cautions, for example, new technologies such as spread spectrum devices, voice privacy, and other digital techniques. Synthesized multi-channel transceivers make it so easy to select a new frequency that some owners of the equipment are tempted to, and do, operate on unauthorized channels to the detriment of others. If synthesized transceivers were equipped with ATIS, the operator would have an incentive not to misuse the built-in channel flexibility since his identity would immediately be known. The utilization of ATIS may help with resolving problems that have arisen with multi-channel synthesizied equipment. Similarly, it will speed decisions on requests for new emissions and technical advances since any resulting interference will always be immediately traceable to the transmission source.

12. Indeed, an intangible benefit stems from the user's knowledge that each transmission is identifiable. The present ability to hide behind the mask of anonymity will be gone and the tide of problems stemming from indifference, callous acts or even deliberate and wanton actions will be contained and turned back. Perhaps not a panacea by itself, but a universal constant like the automobile license tag — it is traceable everywhere in the world.

13. An automatic identification would also negate the necessity for call sign identification of stations operating above 30 MHz. We believe ATIS takes the place of existing voice identification requirements. It should pose no problems internationally, by meeting the broad provisions of the ITU regulations[1] and particularly it would suffice when used on transmitters primarily within the United States and employing a widely published format.

14. As already indicated, the user often has an independent need for ATIS. It provides a unique identifier for calling, billing, tracking, theft deterrence, system access, and other functions. Many users have implemented their own coding method and independently developed the new technology. Others will find it convenient to derive supplemental benefits.

15. The Commission itself foresees a supplemental ATIS benefit of automated technical enforcement monitoring. With every signal containing a coded identifier, it will be possible to rapidly scan a group of channels, make technical measurements such as frequency, modulation, bandwidth, and spurious emission suppression, and relate the measurements to a specific identifiable transmitter. These are all interference critical factors. Automation will equate to a large number of transmissions efficiently measured within a short time period and notification given when there is substantial departure from acceptable limits.

NOTICE OF INQUIRY

19. The Commission is interested in comments concerning ATIS for all services and radio transmitting devices. Included are transmissions regulated under Parts 15, 18, 21, 22, 25, 73, 74, 81, 83, 87, 90, 94, 95 and 97.

20. The establishment of ATIS within a service may be useful for both frequency coordination and enforcement purposes. It would also simplify operational procedures to some extent. However, it would impose costs on the users, both for the necessary hardware and the ongoing need to maintain one or more accurate and up-to-date identification codes. Since it is likely that the costs and benefits will vary from service-to-service, we invite comments on the following questions and any related matters.

(a) In what services would ATIS be beneficial? Should it be imposed on all services?

(b) Could ATIS be mandatory in some services and voluntary in others? For example, ATIS may be valuable in the Marine and Aviation services but unnecessary or impractical in the various Industrial Radio Services.

(c) Would it be feasible to permit stations to ignore normal call sign requirements if those stations employed ATIS? Would this work in some services, such as Broadcast Auxiliary but not others? Would this be confusing or would it provide sufficient incentive for all stations to eventually install ATIS?

21. Critical to our public interest analysis of ATIS is an understanding of two factors: the incentives licensees have to adopt adequate identification systems absent our requirements and the relative costs to licensees of such a program. Each of these factors may be closely related to the characteristics of a particular service. For example, licensees have the greatest incentive to avoid creating interference when they expect to be affected by it in some way. These incentives may be strongest, therefore, in services where licensees either pay a fee to access the radio frequency spectrum or are assigned a channel on an exclusive basis. Even in these cases, however, the inability to converge upon a single standard or other factors may act to prevent the initiation of an optimum ATIS. These types of systems often employ automatic identification systems already.

22. In contrast, licensees on shared frequencies have little reason to avoid creating interference since they are unlikely to reap any daily direct benefit from their efforts. Nevertheless, if <u>all</u> users on a shared channel adopted some form of automatic identification to control unintentional interference, their aggregate gain might outweigh their collective cost. In this instance, a mandatory ATIS might be better justified because of the less tangible benefit to that service's licensees as a whole. Moreover, a case for government intervention might be made in cases where the existence of <u>any</u> interference could be very costly to life and property (e.g., the aviation, marine and public safety services). Even in cases where licensees have little incentive to employ adequate identification methods, however, a government-mandated ATIS program is only in the public interest if its overall benefits outweigh its costs to the economy at large.

23. We request the assistance of interested parties in evaluating the incentives facing licensees in various services and the costs and benefits of various methods of implementing some form of ATIS in some or all services. Any information which may have a bearing on these two factors is welcomed. We are particularly interested in commenters' views on the following:

a) How much would the retail cost of transmitting equipment increase if all transmitters included an ATIS based on the standards described in the Appendix? How would these cost increases be affected by differences in equipment volume? What would be the expected cost of changing an ATIS code in cases where equipment changed hands?

b) What is the percentage of transmitters which are now utilizing form of ATIS (e.g., digital squelch)? What are the future trends?

c) How effective would an ATIS be in resolving interference other than co-channel (e.g., that due to intermodulation, spurious emissions or audio rectification)? What supplemental uses would ATIS have beyond interference resolution?

d) To what degree would the existence of a mandatory ATIS standard based on the present array of communications services (similar to that described in the Appendix) impede or accelerate the development and implementation of new communications technologies?

e) In the frequency bands allocated to the safety services and on channels shared by many licensees, what percentage of traffic is currently disrupted due to interference which may be reduced or eliminated under an ATIS program?

f) What savings occur in service, maintenance and coordination time in identifying sources and more efficiently disposing of a multitude of spectrum management related problems in contrast with present day methods and by the year 2000 and beyond?

24. If an operational ATIS system, were adopted, the use of industry standard codes and circuits would be encouraged. We believe that it may be beneficial for one or more industry groups to study, make recommendations and outline a preferred ATIS method. Comments and supporting data are requested on the following:

(a) When should identification be transmitted? Would identification at the beginning and end of each transmission and every 10 minutes if prolonged be satisfactory?

(b) Should the signal be capable of being easily recognized and decoded by the FCC and other interested parties?

(c) Should the identification code be unique and have linkage to identify the station? What database could serve as linkage? We have suggested the possibility of utilizing an unregistered, but unique code set by the manufacturer, plus the coded station call sign set by the user or service company.

(d) Should the code be tamper proof from the station operator? How could it be made tamper proof?

(e) Would ATIS be practical for a service such as amateur where there is no equipment authorization requirement or the equipment may even be homemade.

(f) How should the code be structured to minimally impact ongoing transmissions?

(g) Should a single standard code be selected? Should provisions for unique situations be provided?

(h) What type of ATIS system should be employed with specifics on code, keying rate, modulation method, error checking, etc?

(i) Should a prototype system be tested prior to a Notice of Proposed Rulemaking? How should testing, if needed, be arranged?

(j) What time schedule should be used for implementation? Should equipment be grandfathered? How should used equipment be regulated? Would the following schedule be realistic?

(1) Parts 81, 83, 89, 90 and 95 — no later than January 1, 1988, for transmitting equipment manufactured after that date, and January 1, 1993, for all transmitting equipment.

(2) Parts 15 (Low Power Communication Devices Only), 21, 22, 25 (including video satellite uplinks with ATIS internal to the transmitter), 74, 94 and 97 — subject to this inquiry but no later than January 1, 1993, for new transmitters and January 1, 1998, for all transmitting equipment.

(3) All other radio services not yet within the ATIS requirements (Parts 15, 18 and 73) — no later than January 1, 2000, for all new equipment.

25. The Commission would welcome the formation of industry groups to address the issues. We would be agreeable to extending the comment period for this Inquiry if such groups request an excension and specify a reasonable time schedule for their activity.

26. No single ATIS method is favored at this time but to stimulate comment a possible system is outlined in the APPENDIX of this Notice.

APPENDIX

For traditional two-way voice communication services, there are a multitude of ATIS methods that could be employed. As supplemental information and a talking point for the inquiry, the following ATIS method has been discussed within the Commission:

(a) The automatic transmitter identification system circuitry shall be so installed that its removal would preclude proper transmitter operation. Its code shall be protected against changing or disabling by the operator. A manufacturer preset unique eight digit code plus a user set call sign will be used.

(b) As a preferred approved method, the automatic transmitter identification system digits shall be transmitted in accordance with the following:

(1) Transmission will be by synchronous, differential phase shift keying at a rate of 1200 (+/- 0.01%) baud. Transmissions shall be compatible with demodulation in accordance with CCITT recommendation V.22.

(2) Transmission carrier shall be 1200 Hz derived from a source of suitable accuracy to achieve the above data rate specification.

(3) Each transmission shall be preceded by the transmission of the equivalent of at least 20 bits of constant "zeros" to initialize the data "scrambler."

(4) Transmissions shall be processed with a 17 bit Psuedo random data scrambler prior to transmission which adheres to the following equation.

D (scr) = D1 + (D14 + D17)

(+ denotes the exclusive or operation)

(5) Transmitted bytes shall consist of eight data bits which can be organized to represent either two hexidecimal digits (packed mode of transmission) or a single ASCII character with a zero most significant bit appended.

(6) Use of industry standard integrated circuits for performing the functions of asynchronous to synchronous conversion, psuedo random scrambling, and DPSK modulation are encouraged.

Call for Papers
Sixth International Conference on Automotive Electronics

The Sixth International Automotive Electronics Conference, which is jointly organized by the Computing and Control and Electronics Divisions of the Institution of Electrical Engineers and the Automobile Division of the Institution of Mechanical Engineers, will be held at the Institution of Electrical Engineers (IEE), Savoy Place, London from 12-15 October 1987.

Papers are now requested for this major international meeting, which has grown in significance and in the breadth and depth of its technical content since the first Conference in 1976, until it is now acknowledged to be the major forum in Europe for automotive electronics presentation and discussion.

It is co-sponsored by automotive and electronic professional societies and institutions in the USA, Japan and Europe, has the patronage of FISITA and alternates every other year with the 'Convergence' International Automotive Electronics Conference in the United States.

The aim of the Conference is to examine both current status and future trends in design, development and operation of electronic components and systems as applied to motor vehicles.

It is intended that major sessions will include:

Power train controls
Displays, information and entertainment systems
Multiplex and system intercommunication
Truck, bus and off highway electronic systems
Navigational and vehicle location systems
Suspension, steering and braking systems
Sensors, actuators and components
Ergonomics, comfort, safety, security and convenience
Electronics quality, reliability and serviceability

Papers are invited on all aspects of automotive electronics related to the above.

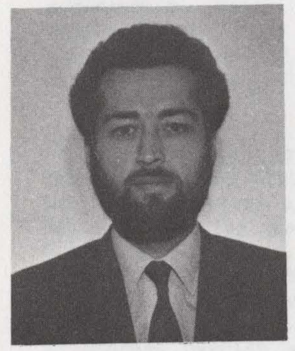
A technical visit to the Ford Research and Engineering Center, Dunton, Essex will be organized for Friday October 16, 1986 at which it is hoped to provide the opportunity for authors and organizations to exhibit and demonstrate relevant vehicles with electronic systems.

IEE OLIVER LUCAS AUTOMOTIVE ELECTRONIC ENGINEERING AWARD

This important international award is made for the most significant paper presented at the Conference. Merit certificates are also presented to the short-listed papers from which the final selection of the award winner is made.

Those wishing to offer a contribution should submit a synopsis of around 1000 words by 6 January 1987 to: Conference Services, IEE, Savoy Place, London WC2R OBL, UK. Telephone 01-240 1871 Extension 222.

Communications



J. R. Cruz
Communications Editor

ABSTRACTS

"A Phase Method Generation of Square-Law SSB Signals," A.M. Lugowski, IEEE Trans. Comm., Vol. COM-34, No. 7, July 1986.

An approximate single sideband signal for a square-law envelope detector (SL-SSB) has the form $\sqrt{1 + x(t)}\cos\{w_0t + 0.5 \arcsin[\hat{x}(t)(1 + 0.5x(t))/1 + x(t))]\}$, where x(t) is the Hilbert transform of x(t). Signal SL-SSB is constructed in accordance with the phase method of SSB signal generation; however, before amplitude modulation a dc component is added to the modulating signal, and then the signal is square-rooted. In this manner a new SL-SSB modulation technique was obtained which is also suitable for C-SSB and AM stereo broadcasting. The SL-SSB spectrum is given.

"Propagation Path Visibility Estimation for Radio Local Distribution Systems in Built-Up Areas," E. Ogawa and A. Satoh, IEEE Trans. Comm., Vol. COM-34, No. 7, July 1986.

For the design of radio local distribution systems in densely built-up areas, estimating how many subscribers are in sight from a nodal station is important. This paper proposes a method for estimating probability of success of line-of-sight paths termed visibility. Method validity is confirmed by practical field examinations.

"Direct-Sequence Spread-Spectrum Multiple-Access Communications Over Nonselective and Frequency-Selective Rician Fading," E. Geraniotis, IEEE Trans. Comm., Vol. COM-34, No. 8, August 1986.

An accurate approximation is obtained for the average probability of error in an asynchronous binary direct-sequence spread-spectrum multiple-access communications system operating over nonselective and frequency-selective Rician fading channels. The approximation is based on the integration of the characteristic function of the multiple-access interference which now consists of specular and scatter components. For nonselective fading, the amount of computation required to evaluate this approximation grows linearly with the product KN, where K is the number of simultaneous transmitters and N is the number of chips per bit. For frequency-selective fading, the computational effort grows linearly with the product KN^2. The resulting probability of error is also compared with an approximation based on the signal-to-noise ratio. Numerical results are presented for specific chip waveforms and signature sequences.

"The Effect of Tree Cover on Air-Ground, VHF Propagation Path Loss," K. Chamberlin, IEEE Trans. Comm., Vol. COM-34, No. 9, September 1986.

A theory accounting for attenuation caused by tree cover for line-of-sight propagation paths at VHF using vertical polarization is presented. An approach to implementing this theory using a terrain-sensitive GTD propagation model is also given. Comparisons of model predictions and airborne measurements show that the approach is valid.

"Nonlinear Techniques for the Improvement of Signal-to-Noise Ratio," M. Shinriki, IEEE Trans. Comm., Vol. COM-34, No. 9, September 1986.

We propose a novel circuit for noise rejection, which is composed mainly of a linear amplifier, a nonlinear amplifier, and a filter. The input signal is applied to a linear amplifier, a bandpass limiter, and an envelope detector followed by a low-pass filter. The output of the low pass filter is multiplied by the output of the bandpass limiter. The difference between the output of the multiplier and linear amplifier is the output of the proposed circuit. It is then indicated that the proposed circuit rejects noise, of which amplitude is narrow-band relative to the desired signal or noise phase.

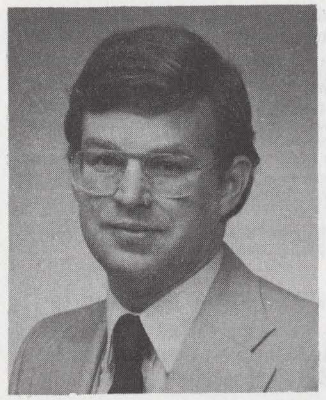
NEW LITERATURE

Results of a study of measured vehicular antenna performance are the subject a report from the National Institute of Justice-Technology Assessment Program. Mobile radio equipment users, engineers and planners might find this publication of interest. The report entitled "Measured Vehicular Antenna Performance," is authored by Ramon L. Jesch from the National Bureau of Standards.

Power gain radiation patterns of mobile antennae mounted in six different locations on a test vehicle were measured with and without typical lights and sirens mounted on the roof.

For a copy, write to Marshall J. Treado, Manager, Communication Systems Program, Law Enforcement Standards Laboratory, National Bureau of Standards, Building 221, Room B157, Gaithersburg, MD 20899.

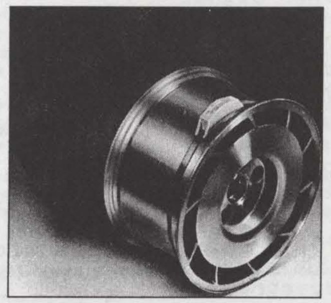
Vehicular Electronics



Bill Fleming
Vehicular Electronics Editor

'87 CORVETTE ON-WHEEL TIRE PRESSURE MONITOR

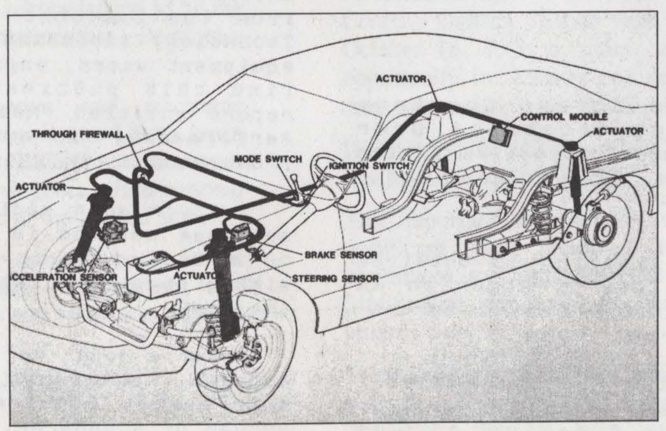
An on-wheel tire pressure monitor called Tele-Tire is standard on selected '87 Corvettes. Developed by Imperial Clevite, the system features sensing modules individually mounted on each wheel. The modules contain hermetically sealed pressure sensors and radio transmitters. The transmitters are powered by tiny piezoelectric voltage generators which convert the moving wheel's mechanical energy into electricity. When tire pressure of an individual tire drops more than one psi below a pre-set level, a dash-mounted warning light is activated [1].



Wheel-Motion Powered Tire Pressure Monitor For '87 Corvettes.

FORD MOTOR AUTOMATIC RIDE CONTROL

On the 1987 Ford Thunderbird, electronically operated automatic ride control is available to help counter acceleration squat, breaking dive, and cornering lean characteristics [1, 2]. The system includes a 2-position mode selector switch on the steering column, sensors that provide speed, steering, brake acceleration and acceleration force inputs; shunt motor actuators on the top of each shock strut and rear vertical shock absorber; an electronic control module; and a wiring harness to connect all the components. Whenever the acceleration sensor detects a change in vehicle longitudinal or lateral motion of more than 0.3 G (except for lateral acceleration, as in cornering, at speeds under 15 mph, or when acceleration is under more than 8 psi of turbo boost, or when the throttle is wide open); the system automatically changes from a soft riding suspension characteristic to a firm riding control characteristic. When a need for firm ride control is indicated, electronic control module sends signals simultaneously to all four actuators. Each actuator then changes the valving restriction of its associated shock absorber piston or shock strut piston to increase resistance to vehicle motion.

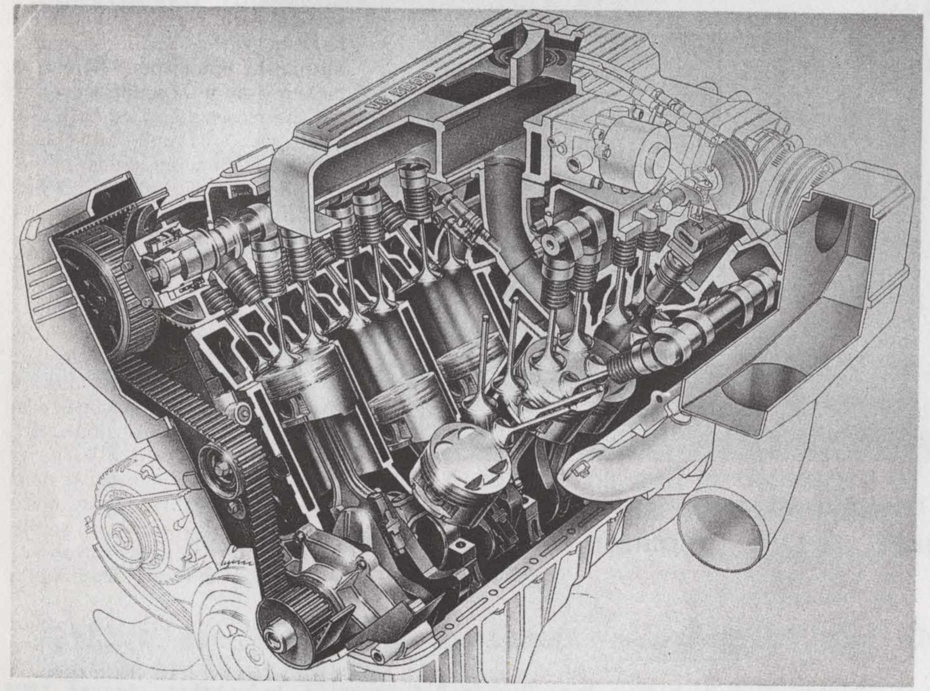


Ford Motor Automatic Ride Control System

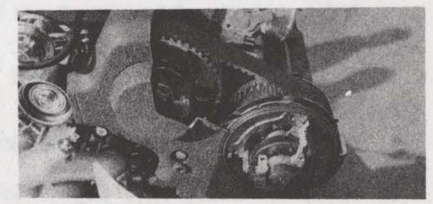
NISSAN VARIABLE VALVE TIMING ENGINE

Darn near everything that can be adjusted by a mechanic on an automobile engine can now be automatically adjusted by means of electronic control systems [3]. In 1979 engine functions such as exhaust gas recirculation, fuel quantity injection, ignition spark timing and engine knock were all electronically controlled. In 1982, sequential control of fuel injection into engine cylinders was added. In 1985, electronic control of turbo charger functions and distributorless ignition systems were added.

This year, Nissan has announced the addition of electronic control of engine valve timing which will be made available on the Nissan Leopard vehicle which includes a quad-cam 24-valve V-6 [4]. On this engine, timing of the exhaust valves are fixed such that the valves open at 55 degrees before bottom dead center and close 13 degrees after top dead center. However, the intake valve timing is adjustable with two settings available which differ by 14 degrees. When the variable valve control system advance is turned on, the intake valve opens at 19 degrees before top dead center and closes at 49 degrees after bottom dead center. When the control system is off, the intake valves open at 5 degrees before top dead center and close at 63 degrees after bottom dead center. This system provides variable overlap between the intake and the exhaust valves which has changed from 32 degrees overlap when the system is off, to an overlap of 18 degrees when the system is on. A solenoid provides the electrical interface to a hydraulic actuating means which moves a helical gear sleeve which, in turn, adjusts the timing of the intake cam shaft. The system is turned on to reduce valve overlap during periods of high engine load at low and medium engine speeds. However, at high engine speeds and high loads the system is turned off thereby increasing the valve overlap to 32 degrees.



Cutaway View of the Nissan Engine Featuring Variable Valve Timing

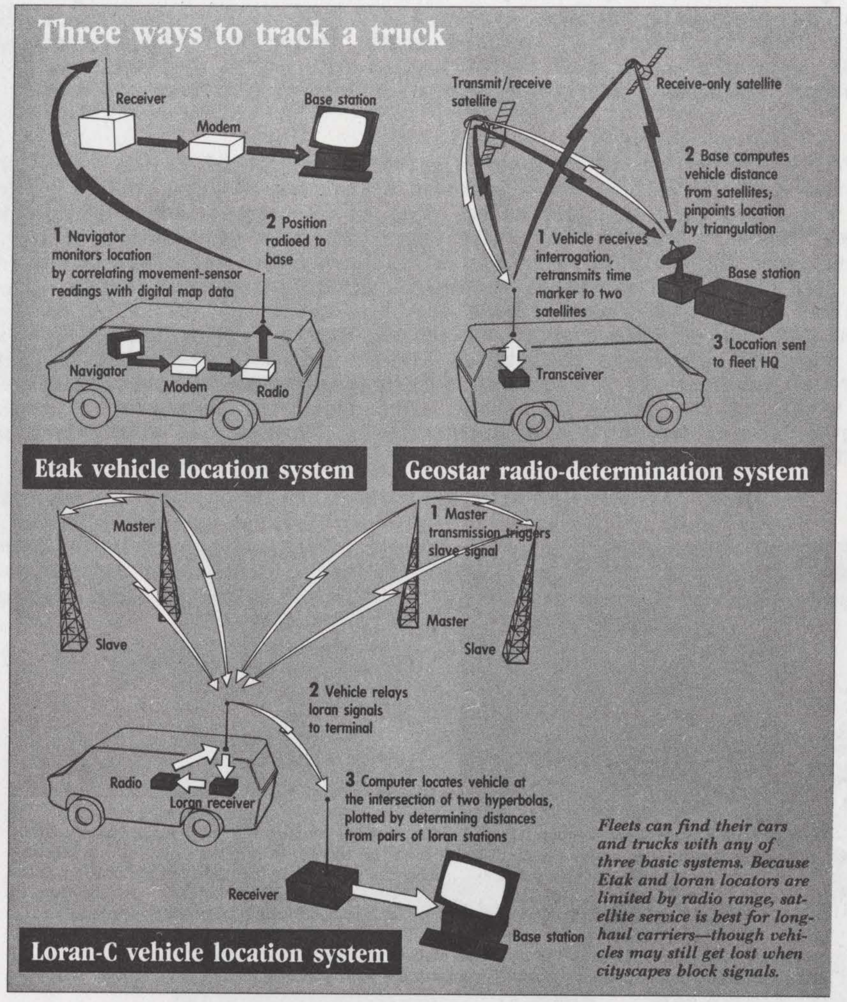


Variable Intake Valve Timing Mechanism -- Cam Pulley and Crank Shaft Angle Sensor Providing Reference Position of Exhaust Cam Shaft.

VEHICULAR POSITION-FINDING SYSTEMS

Vehicular fleets can find their cars and trucks with any of three basic systems. Two of the systems, ETAK and Loran-C, are limited by radio range. The third type of system, based on satellite location information, is the best for long range carriers because it is not limited by radio range. On the other hand, this type of system suffers interference in cities where large buildings or overhead bridges can lockout signal reception.

The market for Positon-Finding vehicular systems is still embryonic, but optimism abounds. Sales of receivers for use with the U.S. Military's satelite-based Global Positioning system will total $50-70 million within the next 15 years. In the United States alone, about 200,000 vehicles are expected to subscribe to privately owned satelite operations over the next seven years time. Usage is expected to climb to half a million systems during the next 20 years [5].



Three Types of Position-Finding Vehicular Location Systems

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Vehicular Technology Society
Land Transportation Committee

C A L L F O R P A P E R S

IEEE/ASME JOINT RAILROAD CONFERENCE

ROYAL YORK HOTEL
APRIL 21-23, 1987
TORONTO, CANADA

The IEEE is the lead society for the 1987 Joint Railroad Conference, and the Land Transportation Committee is seeking abstracts for technical papers to be considered for presentation at this meeting.

Theme papers which review topics of current interest, discuss the design and technical characteristics of current hardware, report R & D work to improve the operation of systems in the railroad and transit industries, or agencies involving new transit starts will be particularly welcome. Topics might include:

- Automation or microprocessor control in the railroad/transit industries
- Energy/fuel efficiency of locomotives
- Electrification alternatives
- Electromagnetic compatibility of dc or ac drives
- High speed rail operations
- Innovations in signalling/communications systems
- Monitoring, fault detection and maintenance of equipment
- Power converter technology and ac/dc drives
- New light rail systems-- planning, design, start-up, etc.
- People mover technology

Authors are requested to submit an abstract for their proposed paper by September 15, 1986 to:

Anthony Daniels
Meetings Chairman, Land Transportation Committee
Railroad and Transit Division
MORRISON-KNUDSEN ENGINEERS, INC.
180 Howard Street
San Francisco, CA 94105

Selected papers are to be submitted on IEEE "Authors' Kit" format by December 15, 1986. For further information, call Anthony Daniels at: (415) 442-7474.

CALL FOR PAPERS

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IEEE VEHICULAR TECHNOLOGY CONFERENCE

June 1-3, 1987

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Papers are sought covering the full range of electronics in vehicular technology, with emphasis on the following topics:

- **Mobile Radio Systems**
  Planning Methodology
- **Mobile Digital Communication Systems**
- **Network System Design**
- **Narrowband Radio Systems**
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  New Technology Operating Experience
  Roamers
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  High Speed Rail, Freight Operations, Urban Transit, People Movers, Power & Drive Systems, Signaling Communications & Control
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- **User Considerations in Radio System Design**
- **Digital Speech Encoding for Land Mobile**
- **Vehicle Location Systems**
- **Automotive Systems**
- **Vehicle Onboard Computer Systems**
- **Electronic Vehicles**
- **Automobile EMI Generation**

Six copies of a 500-word summary should be submitted by December 15, 1986 to:

Professor Gerard Lachs, VTC Technical Coordinator
Department of Electrical Engineering
University of South Florida
Tampa, Florida 33620 USA

To expidite paper evaluation, please classify the topic of the submitted paper using the topics listed above. Authors will be notified of acceptance by January 30, 1987. Author's kits will be sent to the accepted authors with further instructions and deadlines. These papers will be published in the 37th Vehicular Technology Conference Record, which will be available at the conference and from the IEEE Publications Office.

IEEE

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